



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,319	06/19/2001	Mark A. Stan	1613370-0006	4594

7470 7590 07/12/2006

WHITE & CASE LLP
PATENT DEPARTMENT
1155 AVENUE OF THE AMERICAS
NEW YORK, NY 10036

EXAMINER

DIAMOND, ALAN D

ART UNIT PAPER NUMBER

1753

DATE MAILED: 07/12/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

✓

Office Action Summary	Application No.	Applicant(s)	
	09/885,319	STAN ET AL.	
	Examiner	Art Unit	
	Alan Diamond	1753	

~ The MAILING DATE of this communication appears on the cover sheet with the correspondence address ~
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 April 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 54-56,58-82 and 98-120 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 105-111 and 115-120 is/are allowed.
- 6) ☒ Claim(s) 54-56,58-82,98-104 and 112-114 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☒ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 1753

DETAILED ACTION

Comments

1. The objection to the claims for informalities has been overcome by Applicant's amendment and cancellation of the claims.
2. The rejection of the claims under 35 USC 112, first paragraph and second paragraph, have been overcome by Applicant's amendment and cancellation of the claims.
3. The art rejections of claim 54 and its dependent claims over Ringel et al and Olson et al and are moot in view of the fact that claim 54 now recites the limitation that was in claim 57, i.e., a diffused photoactive germanium junction in the substrate.

Priority

4. The filing date of Provisional Application No. 60/212,552 provided by Applicant, i.e., June 19, 2000, does not match the filing date of record in the Office, i.e., June 20, 2000. The priority statement in the specification should be changed to reflect the correct filing date, June 20, 2000.

Oath/Declaration

5. The oath or declaration is defective. A new oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

The oath or declaration is defective because: the filing date of Provisional Application No. 60/212,552 provided in the Declaration does not match Office records. Office records show a filing date of June 20, 2000, whereas said Declaration recites a filing date of June 19, 2000.

Art Unit: 1753

6. The Examiner notes that Applicant filed a Request for Corrected Filing Receipt on May 19, 2003 in order to change the filing date of said Provisional Application on the instant filing receipt from June 20, 2000 to June 19, 2000. As noted in the Response to Request for Corrected Filing Receipt mailed May 27, 2003, the filing date of a parent application cannot be changed by said Request filed May 19, 2003. As noted in said Response mailed May 27, 2003, a petition to correct the filing date in the parent application (60/212,552) is required.

Claim Objections

7. Claim 65 is objected to because of the following informalities: In claim 65, at line 5, the term "from the the" should be changed to "from the". Appropriate correction is required.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

9. Claims 98-104 and 112-114 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claim 98, at lines 8-9, the second cell layer comprising indium gallium arsenide (InGaAs) is not supported by the originally filed disclosure. The same applies to dependent claims 99-104.

In claim 112, at lines 6, 7, and 10, the indium gallium arsenide (InGaAs) nucleation layer is not supported by the originally filed disclosure. The same applies to dependent claims 113 and 114.

Claim Rejections - 35 USC § 102

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

11. Claims 65-68 and 71 are rejected under 35 U.S.C. 102(b) as being anticipated by Chiang et al, Experimental Results of GaInP₂/GaAs/Ge Triple Junction Cell Development for Space Power Systems," 25th IEEE PVSC, May 13-17, 1996, pages 183-186.

As seen in Figure 2 at page 184, Chiang et al teaches a triple junction solar cell having a germanium (Ge) substrate with a subcell formed therein with an n-type Ge layer overlying a p-type Ge substrate, and wherein the n-type Ge layer is formed by diffusion of arsenic; and a GaInP back surface passivating layer formed beneath a

Art Unit: 1753

GaAs middle subcell, wherein said GaInP layer reads on the instant barrier layer (see also the paragraph bridging pages 183 and 184). In particular, it is the Examiner's position that Chiang et al's GaInP layer will inherently prevent diffusion of arsenic from said middle GaAs cell into the Ge substrate. Since Chiang et al teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

12. Claims 54-56, 59-67, 69, 71, and 72 are rejected under 35 U.S.C. 102(e) as being anticipated by Ermer et al (U.S. Patent 6,380,601).

Ermer et al discloses a multijunction solar cell having a germanium substrate (22) doped with an n-type dopant; a nucleation layer (34) comprising of indium gallium phosphide (InGaP), a second cell layer (36) of gallium arsenide (GaAs), and a third cell layer (44) of InGaP (see col. 2, line 53 to col. 4, line 46). The nucleation layer (34) is formed at a preferred thickness of 25 Angstrom to 500 Angstrom and has a lattice parameter at a desired degree of lattice matching to the substrate (22) either "matched, or selectively made non-matching" (see col. 3, lines 28-49). The solar cell of Ermer et al would inherently absorb radiation ranging from UV radiation to a wavelength of 1800 nm through the use of Ge, GaAs and InGaP layers. Phosphorous is the preferred n-type dopant in the Ge substrate 22 (see col. 3, line 1). The junction depth in the Ge substrate (22) ranges from 0.1 microns to 3 microns (see col. 3, lines 7-10).

As subsequent layers are formed, the nucleation layer (34) would control the diffusion of dopant atoms into the substrate (22). At the elevated temperatures at which the semiconductor layers are formed, solid state diffusion of dopants, such as arsenic from the GaAs layer (36), would be controlled by the thickness of the nucleation layer

Art Unit: 1753

(34). Ermer et al discloses that "the invention allows for better passivation of the germanium homojunction substrate and shallower doping profiles with better control over diffused dopant concentrations" (see col. 1, lines 63-66).

Since Ermer et al teaches the limitations of the instant claims, the reference is deemed to be anticipatory.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 65 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olson (U.S. Patent 5,342,453).

With respect to claims 65 and 71, Olson teaches a solar cell comprising a substrate that can be germanium (Ge), a GaInP₂ passivating layer in direct contact with the substrate; and a solar cell containing GaAs over the passivating layer (see col. 3, line 22 through col. 4, line 50; and claims 10, 11, and 15-17; and Figure 1). Said GaInP₂ passivating layer reads on the barrier layer in instant claims 65 and 71. With respect to claim 61, it is the Examiner's position that Olson's solar cell is capable of photoactively converting radiation ranging from approximately UV radiation to radiation having a wavelength of approximately 1800 nm. Olson teaches the limitations of the instant claims, other than the difference which is discussed below.

Art Unit: 1753

Olson does not specifically require the Ge be used as the substrate since the substrate can be selected from three other substrates (see claims 10 and 15).

However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used Ge as the substrate in Olson's solar cell because such is clearly within the scope of Olson's disclosure.

15. Claim 72 is rejected under 35 U.S.C. 103(a) as being unpatentable over Olson as applied to claims 65 and 71 above, and further in view of Friedman et al, "Back Surface Fields for GaInP₂ Solar Cells," IEEE, (1991), pages 358-360.

Olson, as relied upon for the reasons recited above, teaches the limitations of claim 72, the difference being that Olson does not specifically teach the thickness of its GaInP₂ passivating layer. Friedman teaches a GaInP₂ back surface field passivating layer having a thickness of 0.02 microns, i.e., 200 Angstroms (see the entire document, in particular Figure 1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Olson's GaInP₂ passivating layer such that it has a thickness of 200 Angstroms because such is a conventional thickness of a GaInP₂ passivating layer, as shown by Friedman et al.

16. Claims 65-68, 71, and 72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al, Experimental Results of GaInP₂/GaAs/Ge Triple Junction Cell Development for Space Power Systems," 25th IEEE PVSC, May 13-17, 1996, pages 183-186, in view of Friedman et al, "Back Surface Fields for GaInP₂ Solar Cells," IEEE, (1991), pages 358-360.

Art Unit: 1753

As seen in Figure 2 at page 184, Chiang et al teaches a triple junction solar cell having a germanium (Ge) substrate with a subcell formed therein with an n-type Ge layer overlying a p-type Ge substrate, and wherein the n-type Ge layer is formed by diffusion of arsenic; and a GaInP back surface passivating layer formed beneath a GaAs middle subcell, wherein said GaInP layer reads on the instant barrier layer (see also the paragraph bridging pages 183 and 184). In particular, it is the Examiner's position that Chiang et al's GaInP layer will inherently prevent diffusion of arsenic from said middle GaAs cell into the Ge substrate. Chiang et al teaches the limitations of the instant claims, other than the difference which is discussed below.

Chiang et al does not specifically teach the thickness of its GaInP back surface field passivating layer, whereas said claim 72 specifies a thickness of 350 Angstroms or less. Friedman teaches a GaInP₂ back surface field passivating layer having a thickness of 0.02 microns, i.e., 200 Angstroms (see the entire document, in particular Figure 1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Chiang et al's GaInP back surface field passivating layer such that it has a thickness of 200 Angstroms because such is a conventional thickness of a GaInP back surface field passivating layer, as shown by Friedman et al.

17. Claims 65-68, 71, and 73 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al, Experimental Results of GaInP₂/GaAs/Ge Triple Junction Cell Development for Space Power Systems," 25th IEEE PVSC, May 13-17, 1996, pages 183-186, in view of Stanbery (U.S. Patent 4,322,571).

As seen in Figure 2 at page 184, Chiang et al teaches a triple junction solar cell having a germanium (Ge) substrate with a subcell formed therein with an n-type Ge layer overlying a p-type Ge substrate, and wherein the n-type Ge layer is formed by diffusion of arsenic; and a GaInP back surface passivating layer formed beneath a GaAs middle subcell, wherein said GaInP layer reads on the instant barrier layer (see also the paragraph bridging pages 183 and 184). In particular, it is the Examiner's position that Chiang et al's GaInP layer will inherently prevent diffusion of arsenic from said middle GaAs cell into the Ge substrate. Chiang et al teaches the limitations of the instant claims, other than the difference which is discussed below.

Chiang et al does not specifically teach the formation of a two-step diffusion profile in the Ge substrate. Stanbery discloses a method for forming a solar cell with a two-step diffusion profile. The solar cell has areas with a deep junction, which has a high thermal stability, an areas of shallow junctions, which have high light-to-electrical energy conversion efficiencies (col. 5, lines 64-68).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of Chiang et al so as to use a two-step diffusion profile as taught by Stanbery because the two-step diffusion profile has high thermal stability and a high conversion efficiency.

18. Claims 65-71, 74-76, and 78-82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al, Experimental Results of GaInP₂/GaAs/Ge Triple Junction Cell Development for Space Power Systems," 25th IEEE PVSC, May 13-17, 1996, pages 183-186, in view of Wiesmann (U.S. Patent 4,634,605).

Art Unit: 1753

As seen in Figure 2 at page 184, Chiang et al teaches a triple junction solar cell having a germanium (Ge) substrate with a subcell formed therein with an n-type Ge layer overlying a p-type Ge substrate, and wherein the n-type Ge layer is formed by diffusion of arsenic; and a GaInP back surface passivating layer formed beneath a GaAs middle subcell, wherein said GaInP layer reads on the instant barrier layer (see also the paragraph bridging pages 183 and 184). In particular, it is the Examiner's position that Chiang et al's GaInP layer will inherently prevent diffusion of arsenic from said middle GaAs cell into the Ge substrate. Chiang et al teaches the limitations of the instant claims, other than the difference which is discussed below.

Chiang et al does not specifically teach that its n-type Ge layer is formed by diffusion of phosphorous or both phosphorous and said arsenic. Wiesmann discloses the use of both arsenic and phosphorous in combination as an n-type dopant (col. 7, lines 21-25). The use of arsenic and phosphorous as n-type dopants is very well known in the art, and they are functional equivalents of each other.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the n-type dopant in the solar cell of Chiang et al so as to use phosphorous or both phosphorous and arsenic, as taught by Wiesmann, because phosphorous and arsenic are functional equivalents. With respect to claim 74 and its dependent claims, it would have been well within the skill of an artisan to have used, for example, much more phosphorous dopant than arsenic dopant, thus resulting in a higher concentration of phosphorous atoms than arsenic atoms throughout the

Art Unit: 1753

diffusion region (including the upper portion has here claimed), which the expectation that an n-doped germanium diffusion layer would be obtained in a working solar cell.

19. Claims 72 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiang et al in view of Wiesmann as applied to claims 65-71, 74-76, and 78-82 above, and further in view of Friedman et al, "Back Surface Fields for GaInP₂ Solar Cells," IEEE, (1991), pages 358-360.

Chiang et al in view of Wiesmann, as relied upon for the reasons recited above, teaches the limitations of claims 72 and 77, the difference being that Chiang et al does not specifically teach the thickness of its GaInP back surface field passivating layer, whereas said claims 72 and 77 specify a thickness of 350 Angstroms or less. Friedman teaches a GaInP₂ back surface field passivating layer having a thickness of 0.02 microns, i.e., 200 Angstroms (see the entire document, in particular Figure 1). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have prepared Chiang et al's GaInP back surface field passivating layer such that it has a thickness of 200 Angstroms because such is a conventional thickness of a GaInP back surface field passivating layer, as shown by Friedman et al.

20. Claims 54-56, 58-72 and 74-82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ermer et al (U.S. Patent 6,380,601) in view of Wiesmann (U.S. Patent 4,634,605).

Ermer et al discloses a multijunction solar cell having a germanium substrate (22) doped with an n-type dopant; a nucleation layer (34) comprising of indium gallium phosphide (InGaP), a second cell layer (36) of gallium arsenide (GaAs), and a third cell

Art Unit: 1753

layer (44) of InGaP (see col. 2, line 53 to col. 4, line 46). The nucleation layer (34) is formed at a preferred thickness of 25 Angstrom to 500 Angstrom and has a lattice parameter at a desired degree of lattice matching to the substrate (22) either "matched, or selectively made non-matching" (see col. 3, lines 28-49). The solar cell of Ermer et al would inherently absorb radiation ranging from UV radiation to a wavelength of 1800 nm through the use of Ge, GaAs and InGaP layers. Phosphorous is the preferred n-type dopant in the Ge substrate 22 (see col. 3, line 1). The junction depth in the Ge substrate (22) ranges from 0.1 microns to 3 microns (see col. 3, lines 7-10).

As subsequent layers are formed, the nucleation layer (34) would control the diffusion of dopant atoms into the substrate (22). At the elevated temperatures at which the semiconductor layers are formed, solid state diffusion of dopants, such as arsenic from the GaAs layer (36), would be controlled by the thickness of the nucleation layer (34). Ermer et al discloses that "the invention allows for better passivation of the germanium homojunction substrate and shallower doping profiles with better control over diffused dopant concentrations" (see col. 1, lines 63-66).

Ermer et al teaches the limitations of the instant claims, other than the difference which is discussed below.

Ermer et al does not specifically teach the use of arsenic or both phosphorous and arsenic in place of the phosphorous that is used to form the n-type dopant layer in its Ge substrate (22). Wiesmann discloses arsenic, phosphorous, or the use of both arsenic and phosphorous in combination as an n-type dopant (col. 7, lines 21-25). The

Art Unit: 1753

use of arsenic and phosphorous as n-type dopants is very well known in the art, and they are functional equivalents of each other.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the n-type dopant in the solar cell of Ermer et al so as to use arsenic or both phosphorous and arsenic, as taught by Wiesmann, because phosphorous and arsenic are functional equivalents. With respect to claim 74 and its dependent claims, it would have been well within the skill of an artisan to have used, for example, much more phosphorous dopant than arsenic dopant, thus resulting in a higher concentration of phosphorous atoms than arsenic atoms throughout the diffusion region (including the upper portion has here claimed), which the expectation that an n-doped germanium diffusion layer would be obtained in a working solar cell.

21. Claim 73 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ermer et al in view of Wiesmann as applied to claims 54-56, 58-72 and 74-82 above, and further in view of Stanbery (U.S. Patent 4,322,571).

Ermer et al in view of Wiesmann, as relied upon for the reasons recited above, teaches the limitations of claim 73, the difference being that Ermer et al in view of Wiesmann does not specifically teach the formation of a two-step diffusion profile, i.e., first and second diffusion sublayers in the Ge substrate. Stanbery discloses a method for forming a solar cell with a two-step diffusion profile. The solar cell has areas with a deep junction, which has a high thermal stability, an areas of shallow junctions, which have high light-to-electrical energy conversion efficiencies (col. 5, lines 64-68).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the solar cell of Ermer et al in view of Wiesmann so as to use a two-step diffusion profile as taught by Stanbery because the two-step diffusion profile has high thermal stability and a high conversion efficiency.

Response to Arguments

22. Applicant's arguments filed April 26, 2006 have been fully considered but they are not persuasive.

Applicant argues that even if the GaInP layer of Chiang et al prevented diffusion of arsenic from the middle GaAs cell into the substrate, the GaInP layer does nothing to prevent diffusion of arsenic from the two GaAs tunnel junction layers into the Ge substrate. However, this argument is not deemed to be persuasive because Chiang et al's GaAs tunnel junction layers are not excluded by the "comprising" language of instant claim 65. Claim 65 recites "a barrier layer overlying said substrate and underneath said solar subcell layer and functioning to inhibit the diffusion of arsenic from the the (sic) solar subcell into the germanium substrate." Chiang et al's GaInP layer will prevent diffusion of arsenic from the middle GaAs cell into the substrate, and thus, meets the limitation of the instant claim.

Applicant argues that the Rule 1.131 Declaration filed August 3, 2004 establishes that the instant invention is invented prior to March 29, 1999, i.e., the U.S. filing date of Ermer et al. However, this argument is not deemed to be persuasive for the following reasons. None of claim 54 and its dependent claims is commensurate in scope with the particular triple junction solar cell prepared as seen in the data of said Declaration.

Art Unit: 1753

Likewise, none of instant claims 65-82 are commensurate in scope with the particular triple junction solar cell prepared as seen in the data of said Declaration. Furthermore, none of the data in said Declaration show what is now recited in instant claims 65-82.

Applicant argues that the 200 Angstrom thickness taught by Friedman et al does not read upon the limitation "350 Angstroms or less". However, this argument is not deemed to be persuasive 200 Angstroms clearly is within the instant range of 350 Angstroms or less and thus, anticipates and renders obvious this limitation.

With respect to claim 74, Applicant argues that the Office has failed to provide a single reason that one would use diffusion regions with different dopings. However, this argument is not deemed to be persuasive because, in order to meet the limitation of claim 74, the concentration of phosphorus (P) atoms can be higher than the concentration of arsenic (As) atoms not only in and upper portion of the diffusion region, but throughout the diffusion region. Wiesmann discloses the use of both arsenic and phosphorous in combination as an n-type dopant (col. 7, lines 21-25). The use of arsenic and phosphorous as n-type dopants is very well known in the art, and they are functional equivalents of each other. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the n-type dopant in the solar cell of Chiang et al so as to use phosphorous or both phosphorous and arsenic, as taught by Wiesmann, because phosphorous and arsenic are functional equivalents. It would have been well within the skill of an artisan to have used, for example, much more phosphorous dopant than arsenic dopant, thus resulting in a higher concentration of phosphorous atoms than arsenic atoms throughout the diffusion

Art Unit: 1753

region (including the upper portion has here claimed), which the expectation that an n-doped germanium diffusion layer would be obtained in a working solar cell. The use of a 50/50 mixture of P and As, or something very close to it, such as 51/49 P/As or 50.1/49.0 P/As would have been well within the skill of an artisan.

Allowable Subject Matter

23. Claims 105-111 and 115-120 are allowed.

24. The following is a statement of reasons for the indication of allowable subject matter: Claims 105-11 and 115-120 are identical to corresponding claims allowed in the Notice of Allowability and Reasons for Allowance mailed March 24, 2004.

Conclusion

25. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Art Unit: 1753

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alan Diamond whose telephone number is 571-272-1338. The examiner can normally be reached on Monday through Friday, 5:30 a.m. to 2:00 p.m. ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Alan Diamond
July 9, 2006

Alan Diamond
Primary Examiner
Art Unit 1753

A handwritten signature in black ink, appearing to read 'Alan Diamond', with a stylized flourish at the end.